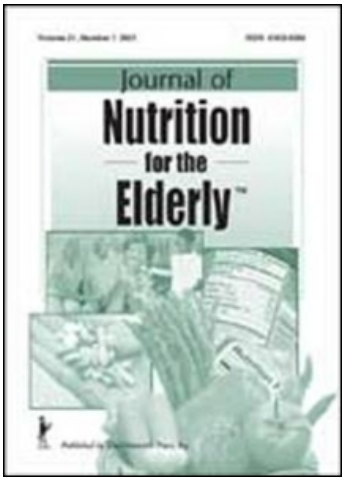

Journal of Nutrition For the Elderly
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t792306906

Documenting the Need for Nutrition and Health Intervention for Middle-aged and Older Adults in the Lower Mississippi Delta Region

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To cite this Article Johnson, Glenda S. , McGee, Bernestine B. , Gossett, Jeffrey M. , Thornton, Alma , Simpson, Pippa M. , Johnson, Crystal , Richardson, Valerie , Bogle, Margaret , James-Holly, Dawanna and McCabe-Sellers, Beverly(2008) 'Documenting the Need for Nutrition and Health Intervention for Middle-aged and Older Adults in the Lower Mississippi Delta Region', Journal of Nutrition For the Elderly, 27: 1, 83 — 99
To link to this Article: DOI: 10.1080/01639360802060108
URL: http://dx.doi.org/10.1080/01639360802060108

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Journal of Nutrition for the Elderly, Vol. 27(1/2) 2008
Available online at http://jne.haworthpress.com

doi: 10.1080/01639360802060108

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ABSTRACT. Multiple demographic, health, and environmental factors may influence the overall quality of diets among rural middle-aged and older adults. This project compared the diet quality of participants in Foods of Our Delta Survey (FOODS 2000) who were aged 55 years and older with national data. The data were assessed using 24-hour dietary recall methodology and a modified version of the United States Department of Agriculture Healthy Eating Index (HEI) that excluded the sodium component. The mean total Modified Healthy Eating Index (MHEI) study score was significantly lower than their counterparts from the national survey (61.0 ± 0.68 vs. 65.6 ± 3.65, $P < 0.0001$). Race and educational attainment were associated with higher MHEI scores. This study emphasized a critical need for implementing nutrition and health interventions in rural communities with special attention to subpopulations at risk.

KEYWORDS. Chronic diseases, dietary quality, HEI, middle-aged adults, nutrition and health intervention, older adults, rural

INTRODUCTION

Older adults, particularly those living in rural areas, represent an increasing segment of the US population. Data from the National Center for Health Statistics, Centers for Disease Control and Prevention (CDC, 2003) indicate that by year 2030, 25% of the older adult population will reside in rural areas and only 15% will reside in metropolitan areas.

With advancing age, the risk of developing chronic illnesses, such as high blood pressure, stroke, type 2 diabetes, coronary heart disease, and certain types of cancer increases (US Administration on Aging, 2004). Currently, 80% of older adults live with at least one chronic condition and 50% have at least two (Wan et al., 2005). According to the US Census Bureau, adults in the 55–64 years group begin to experience chronic health problems typical of older adults

(CDC, 2003). These statistics have implications for health care researchers, practitioners, and policymakers.

Consuming a high-quality diet, particularly one rich in fruits and vegetables, may aid in preventing or delaying the onset of chronic diseases (Joshipura et al., 1999; Steinmetz & Potter, 1996; Liu et al., 2000; Ford & Mokdad, 2001) and facilitate maintenance of independence in older adults (Nicolas et al., 2001; Amarantos et al., 2001). However, studies suggest that many older individuals do not meet dietary guidelines (Foote et al., 2000; Boeckner et al., 2007; Guenther et al., 2006; Ledikwe et al., 2004; Vitolins et al., 2002), especially fruit and vegetable recommendations (Prochaska et al., 2005; Sahyoun et al., 2005; Johnson, 1998). A major challenge for health professionals today is planning nutrition interventions to improve overall diet and nutritional health among older adults and thereby reducing their risk for chronic diseases.

A recent focus in the area of dietary assessment has been to measure diet quality from diverse perspectives and in a comprehensive manner (Kim et al., 2003). Researchers reported that scores for overall diet measures were associated with plasma biomarkers related to diet (Hann et al., 2001; Weinstein et al., 2004) and were more strongly associated with disease risk than are single-index measures (Kant, 1996). Only a few studies have investigated the total diet quality in the older adult population (Sahyoun & Zhang, 2005; Ledikwe et al., 2004; Finke & Huston, 2003; Juan et al., 2004; Pullen & Noble, 2002; Vitolins et al., 2002, 2007).

Older adults living in rural areas may be at additional risk due to their unique demographic profile (Federal Interagency Forum on Aging-Related Statistics, 2004). They generally have lower income, less education and access to health care services, and poorer health status (Gamm and Hutchison, 2004). It is difficult to accurately document dietary and nutritional health among rural older adults because some rural regions have been underrepresented in national food consumption surveys. This was the result of sample numbers that were too small to adequately describe nutritional health of underrepresented regions. In addition, some regions have high concentrations of African Americans, Hispanics, and persons of poverty-level income, contributing to tremendous disparity in the prevalence of diet-related chronic diseases among regions (Arab et al., 2003).

The Lower Mississippi Delta (LMD) represents a rural area not adequately evaluated for nutrition status and diet-related diseases

(The Lower Mississippi Delta Nutrition Intervention Research Consortium, 1997). Traditionally agricultural, it borders the Mississippi River in Arkansas, Louisiana, and Mississippi, and is characterized by high poverty, low educational attainment, and high prevalence of diet-related chronic diseases (Smith et al., 1999). Because of well-documented needs and exceptional nutrition intervention research opportunities in this region, the Agricultural Research Service of the US Department of Agriculture (USDA) was directed by Congress in 1994 to study the effects of nutrition intervention on the health of this population (US Senate Report 103–290).

The objectives of the current study were to compare the total diet quality among LMD older adults with national data and to identify demographic and personal characteristics associated with dietary quality. These data can assist health care researchers, practitioners, and community residents in developing and implementing interventions that will improve nutritional health in subgroups in this heterogeneous and vulnerable population. To our knowledge, this is the largest regional, predominately rural but not exclusively rural, sample of older adults that consist of a majority of African Americans.

METHODS

Dietary Data

Data for this study were taken from Foods of Our Delta Survey (FOODS 2000) (Champagne et al., 2004) and the 1994–1996 Continuing Survey of Food Intakes by Individuals (CSFII) (USDA, 2000). FOODS 2000, a cross-sectional telephone survey using list-assisted random-digit dialing, was conducted in a representative sample of the population three years-of-age and older in 36 LMD counties using a stratified, two-stage probability sample design. Further details of sampling, data collection, and data processing methodology used have been printed in previous publications (Champagne et al., 2004; Stuff et al., 1997). Data relevant to this study included self-reported food intake measured by one 24-hour dietary recall and demographic and personal characteristics of older adults aged 55 years and older.

The CSFII 1994–1996, 1998, a sample weighted so that it is nationally representative, contains information regarding Americans' food intake obtained from two 24-hour dietary recalls. Since FOODS 2000 collected only the one 24-hour recall, only Day 1 of the two 24-hour recall intakes from CSFII was used. One of the strengths of the comparisons is that the same contractor, Westat, conducted the dietary interviews for both surveys. Both surveys' data were coded using the USDA dietary data base; however, slightly different assumptions were made concerning optional sodium in recipes (Champagne et al., 2004).

Subjects

The study sample consisted of 561 rural, non-Hispanic African American and white respondents, who were 55 years of age and older, selected from a total of 1,751 adults who completed the FOODS 2000 Survey. The sample was weighted to reflect the population of the LMD (Champagne et al., 2004; Stuff et al., 2004). The overall dietary quality of the LMD respondents was compared with 3,645 adults of the same age and ethnicity groups taken from the total of 10,164 adults in the CSFII 1994–1996 study.

Demographic and Personal Characteristics

Several demographic and personal characteristics were selected from the available data: sex, self-identified race/ethnicity, educational attainment, household income, nutrition assistance, self-reported height and weight, physical activity, and general health status. Examinations of selected variables were made between the LMD and CSFII samples and within the LMD respondents. Body mass index (BMI) was determined from self-reported height and weight and grouped accordingly: normal ($BMI < 25$), overweight ($25 \geq BMI < 30$), and obese ($BMI \geq 30$) (National Heart, Lung, & Blood Institute, 1998).

Healthy Eating Index

The 2000 Healthy Eating Index (HEI) is a tool designed to assess overall diet quality and conformance to federal guidelines.

It is comprised of 10 components that represent different aspects of a healthful diet. The first five components measure adherence to recommendations for the food groups of the Food Guide Pyramid: grains, vegetables, fruits, milk, and meat. Components 6 and 7 measure total fat and saturated fat consumption as a percentage of total food energy intake; components 8 and 9 measure total cholesterol and sodium intake; and component 10 measures the degree of variety in a person's diet. Scores for each component range from 0 to 10, with 10 indicating the highest score and 100 indicating the highest attainable HEI score (Kennedy et al., 1995).

Modified Total Healthy Eating Index

Sodium intake is difficult to accurately assess by a telephone survey. Using standard USDA recipes to calculate sodium content of food would have required several additional survey questions and added to the telephone respondent burden. Thus, two decisions were made: (1) to assume no salt added in recipes and (2) to construct a modified total HEI score (MHEI) to avoid inconsistencies among sodium intake data collected and coded in the two surveys. The MHEI score is the HEI total score (Kennedy et al., 1995) minus the sodium score and rescaled (by a factor of 10/9) to have a maximum score of 100.

Statistical Analysis

Comparisons of MHEI and component scores were made using independent sample z-tests of weighted estimates. For each comparison in the surveys, mean and standard error estimates were calculated separately for each survey and a z-score was constructed assuming unequal variances. The *p*-values for the comparisons have not been adjusted for multiple comparisons. Rather than the standard alpha level of 0.05 *p*-values should be compared with a more conservative 0.01 when assessing significance. In the LMD sample, a multiple regression model was fit to MHEI with race, sex, age group, household nutrition assistance, household income, education level, BMI classification, and general health status of the respondents as predictors.

RESULTS

LMD and CSFII Demographic and Personal Characteristics

Table 1 compares the distribution of demographic and personal characteristics between LMD and national data. The percentages are weighted. The LMD sample had a higher percentage of females and African Americans and lower levels of educational attainment and household income than the CSFII respondents. Approximately 16% of LMD respondents compared with 6% of CSFII respondents reported that at least one member of their household participated in food assistance programs (e.g., Women, Infants, and Children [WIC], food stamps, and school meals programs). LMD respondents had more BMI measurements associated with being overweight and obesity than CSFII respondents. Over half the LMD sample rated their general health as good; no health rating data are available from CSFII. Although statistical significance is only $P \leq 0.09$, there is a trend for less normal weight, more overweight, more obese, and especially more severely obese in the LMD compared with CSFII older adults.

MHEI and Component Scores

MHEI and component scores summarized diet quality of LMD and CSFII respondents (Table 2). The overall MHEI score for LMD respondents was significantly ($P \leq 0.01$) lower than the score reported for the CSFII respondents. Differences in respondents' adherence to various aspects of dietary recommendations were assessed by comparing MHEI component scores. LMD scores were significantly ($P \leq 0.01$) lower than CSFII scores for vegetable, fruit, total fat, and variety components. There were no differences in the dairy, grains, meat, cholesterol, and saturated fat scores between the two groups.

MHEI and component scores were also compared according to ethnicity (Table 2). There was a significant difference ($P \leq 0.01$) in mean MHEI scores of LMD whites, 57.2 ± 0.82, compared with scores of CSFII white respondents, 66.5 ± 0.44. LMD whites reported significantly ($P \leq 0.01$) lower intakes of vegetables, fruits ($P \leq 0.01$), and fats ($P \leq 0.03$). LMD African Americans had significantly lower ($P \leq 0.02$) vegetable scores than CSFII African Americans.

TABLE 1. Comparisons of Demographic and Personal Characteristics for Lower Mississippi Delta[a] (LMD) and Continuing Survey of Food Intakes of Individuals[b] (CSFII) Adults Ages 55+

Characteristic	LMD n = 561		CSFII 1994–1996 n = 3645	
	Number	Percent (SE)	Number	Percent (SE)
Age (years) and sex				
55–64				
Males	84	40.7 (3)	725	44.3 (1.0)
Females	137	59.3 (3)	735	55.7 (1.0)
65+				
Males	105	40.5 (2.7)	1135	42.2 (0.5)
Females	235	59.5 (2.7)	1050	57.8 (0.5)
Education Level				
Less than high school	220	37.9 (2.4)	1152	28.5 (0.9)
High school/GED/trade school/some college/college graduate	330	59.6 (2.3)	2432	69.7 (0.8)
Unknown	11	2.4 (0.7)	61	1.7 (0.3)
Annual Household Income				
$0–$14,999	199	30.9 (2.3)	1032	22.1 (0.9)
$15,000–$29,999	128	23.9 (2.2)	1053	28.6 (1.2)
$30,00+	163	31.6 (2.2)	1560	49.4 (1.3)
Unknown	71	13.6 (1.7)	0[d]	
Ethnicity/Race				
African Americans	223	35.5 (1.7)	447	11.9 (1.0)
Whites	338	64.5 (1.7)	3198	88.1 (1.0)
Nutrition Assistance[c]				
Household receives assistance	99	15.7 (1.8)	271	6.1 (0.4)
Does not receive assistance	450	75.3 (1.8)	3360	93.5 (0.4)
Unknown	12	3.4 (1.1)	14	0.5 (0.2)
BMI Group				
$00 \leq \text{BMI} < 18$	8	1.7 (0.9)	125	3.9 (0.4)
$18 \leq \text{BMI} < 25$	160	27.2 (2.2)	1443	40.5 (1)
$25 \leq \text{BMI} < 30$	210	38.3 (2.6)	1378	36.9 (0.9)
$30 \leq \text{BMI} < 40$	147	26.8 (2.1)	650	17.4 (0.5)
$40 \leq \text{BMI}$	21	3.2 (0.9)	49	1.2 (0.3)
Unknown	15	2.8 (0.8)		
Self-rating of General Health[e]				
Good	359	66.1 (2.2)		
Fair	128	21.6 (1.7)		
Poor	68	11.1 (1.4)		
Unknown	6	1.2 (0.6)		

[a]Foods of Our Delta (FOODS) 2000 non-Hispanic whites and African Americans.

[b]CSFII 1994–1996 non-Hispanic whites and African Americans.

[c]Nutrition assistance programs refers to at least one person in the household participating in one of the following: WIC, food stamps, and school meal programs.

[d]No missing data in CSFII set due to imputation.

[e]Self-rated health not available from CSFII data set.

TABLE 2. Comparisons of Mean (plus/minus SE) Modified Healthy Eating Scores[a] HEI and Component Scores[b] for Lower Mississippi Delta[c] (LMD) and Continuing Survey of Food Intakes of Individuals[d] (CSFII) Adults Aged 55+

	African Americans and Whites			African Americans			Whites		
	LMD Mean (SE1) n = 561	CSFII Mean (SE1) n = 3644	LMD-vs.-CSFII *P*-value	LMD Mean (SE) N = 223	CSFII Mean (SE) n = 447	LMD-vs.-CSFII *P*-value	LMD Mean (SE) N = 338	CSFII Mean (SE) n = 3197	LMD-vs.-CSFII *P*-value
MHEI[#,##]	61.0 (0.7)	65.6 (3.6)	<0.001	56.4 (1.0)	59.1 (1.4)	0.11	63.4 (0.9)	66.5 (0.4)	0.03
Grains	6.4 (0.1)	6.5 (0.1)	0.44	5.7 (0.2)	5.7(0.1)	0.91	6.8 (0.2)	6.6 (0.1)	0.33
Vegetables	5.5 (0.1)	6.7 (0.1)	<0.001	4.5 (0.2)	5.8(0.3)	0.018	6.1 (0.2)	6.8 (0.1)	0.001
Fruit	4.1 (0.2)	4.9 (0.1)	<0.001	4.0 (0.2)	4.4 (0.3)	0.29	4.2 (0.2)	5.0 (0.1)	0.001
Dairy	4.5 (0.2)	4.9 (0.1)	0.06	3.2 (0.3)	3.3 (0.2)	0.74	5.3 (0.2)	5.1 (0.1)	0.42
Meat	6.9 (0.1)	6.6 (0.1)	0.03	6.6 (0.2)	7.0 (0.2)	0.14	7.2 (0.2)	6.6 (0.1)	0.009
Total Fat	6.0 (0.2)	6.7 (0.1)	0.01	6.3 (0.2)	6.4 (0.2)	0.63	5.8 (0.2)	6.7(0.1)	0.003
Saturated Fat	6.5 (0.2)	6.7 (0.1)	0.22	6.9 (0.3)	6.7 (0.2)	0.53	6.3 (0.3)	6.7 (0.1)	0.07
Cholesterol	7.5 (0.2)	8.0 (0.1)	0.03	7.3 (0.4)	7.3 (0.2)	0.95	7.7 (0.2)	8.1 (0.1)	0.06
Variety	7.4 (0.1)	8.0 (0.6)	<0.001	6.4 (0.2)	6.7 (0.3)	0.50	8.0 (0.1)	8.2 (0.1)	0.17

[a]Maximum value = 100 (after rescaling).
[b]Maximum value is 10 for each component score.
[c]Foods of Our Delta (FOODS) 2000 non-Hispanic whites and African Americans.
[d]CSFII 1994–1996 non-Hispanic whites and African Americans.

TABLE 3. Linear Regression Model to Predict Modified HEI Using the FOODS 2000 Sample[a]

Independent Variable	Effects	Beta (Std Err)	Wald P-value (Beta = 0)	Adjusted Mean[b] (Std Err)	Overall Effect *P*-value
Race	White	5.7 (1.6)	0.0008	63.2 (1.1)	0.0008
	African American	0		57.5 (1.1)	
Sex	Male	−1.9 (1.8)	0.28	60.3 (1.3)	0.28
	Female	0		62.2 (1)	
Age Group	55 to 64	−3.2 (1.9)	0.095	59.7 (1.3)	0.095
	65 and older	0		62.9 (1.2)	
Household Received Nutritional Assistance[c]	Yes	2.3 (2.1)	0.29	63.2 (1.9)	0.29
	No	0		60.9 (0.9)	
Weight Status[d]	Normal	−0.1 (2)	0.95	59.8 (1.2)	0.073
	Overweight	4 (2)	0.048	63.9 (1.4)	
	Obese	0		59.9 (1.6)	
Household Income[e]	Less than $15,000	−1 (2.9)	0.74	61 (2)	0.93
	$15,000 to <$30,000	−0.7 (2.1)	0.73	61.2 (1.6)	

	$30,000 and up	0		62 (1.4)	
Education	Less then High School	−8.5 (2.6)	0.002	59.7 (1.3)	0.003
	HS/ GED / Trade / some college	−7.9 (2.4)	0.002	60.3 (1.4)	
	College graduate	0		68.2 (2)	
Self reported General Health	Excellent / Very Good / Good	−1.8 (2.4)	0.47	61.8 (1.1)	0.22
	Fair	−4.3 (2.6)	0.096	59.2 (1.6)	
	Poor	0		63.5 (2)	

[a]Overall *p*-value for the model was <0.0001. The intercept estimated was 67.1 (4.1).

[b]Adjusted means are least squares estimates and are adjusted for all the predictors in the model.

[c]Nutritional assistance includes benefits to any member of the household WIC, school lunch programs, food stamps, head start, summer feeding programs, Aid to Families with Dependent Children (AFDC)/Temporary Aid to Needy Families (TANF), and elderly nutrition programs such as Meals on Wheels.

[d]Weight status is based on body mass index (BMI) estimates constructed using self-reported heights and weights. Normal ($BMI < 25$), overweight ($25 \leq BMI < 30$), obese ($BMI \geq 30$).

[e]Household income represents 1999 income from all sources, including wages, tips, Social Security, AFDC, TANF, child support, or any cash income from other sources.

As the income increased, MHEI and component scores of both LMD and CSFII respondents improved. In the less than $30,000 income category, CSFII respondents had higher mean MHEI ($P \leq 0.05$), fat ($P \leq 0.02$), and fruit ($P \leq 0.09$) scores than LMD respondents. CSFII respondents had higher vegetable scores ($P \leq 0.05$) in the low and moderate income categories (data not shown).

LMD respondents with high school education and higher had significantly ($P \leq 0.01$) higher total MHEI scores than CSFII counterparts. However, CSFII respondents with the same education attainment had significantly higher ($P \leq 0.01$) component scores than LMD counterparts for variety ($P \leq 0.02$), fruit ($P \leq 0.01$), and vegetable ($P \leq 0.01$) categories (data not shown).

LMD male and female respondents had significantly ($P \leq 0.01$) lower MHEI scores than CSFII counterparts. In comparing component scores of LMD and CSFII male respondents, there were differences in vegetable ($P \leq 0.01$), dairy ($P \leq 0.02$), and variety scores ($P \leq 0.01$). The LMD females had lower MHEI ($P < 0.0001$), vegetable ($P \leq 0.01$), fruit ($P \leq 0.01$), and total fat ($P \leq 0.01$) scores than CSFII females (data not shown).

The effect of demographic and personal characteristics on the LMD MHEI score is shown by the regression coefficients, which are adjusted for all variables (Table 3). Race and education were significant ($P \leq 0.005$) predictors in the model. Whites had a higher adjusted mean score (63.2 vs. 57.5) than African Americans. College graduates had a higher adjusted mean score than either less than high school (68.3 vs. 59.7) and high school/GED/trade school/some college (68.3 vs. 60.3).

DISCUSSION

Rural middle-aged and older adults comprise unique, heterogeneous segments of the US population; however, limited evaluation has been conducted on the diet quality in a representative sample. This study is one of the first to examine diet quality in a large representative sample of older adults in a region that is predominantly rural with a majority of the population being African American. The mean MHEI score for the LMD respondents (61.0) may be attributed to lower fruit, vegetable, total fat, and variety scores than

the CSFII respondents. Other studies that assessed diet quality of rural older adults using the HEI found mean HEI scores ranged from 62.6 to 74.0 (Sahyoun & Zhang, 2005; Juan et al., 2004; Bailey et al., 2004; Ledikwe et al.; 2004; Vitolins et al., 2007).

Demographic variance is an important influence on the diet quality in middle-aged and older adults. LMD female respondents had a higher MHEI score than their LMD male counterparts, but the LMD male score was lower in comparison to US males. Overall, LMD African Americans had diets of lower quality, as reflected by MHEI and component scores than LMD white or US white middle-aged and older adults. After adjusting for other demographic factors, whites and respondents with the highest educational attainment were less likely to suffer from a poor diet. These findings support an earlier investigation conducted by Lee et al. (1998), who found that income and education levels played a significant role in the nutrition quality of rural older adults.

This study documents the low quality of diets consumed by middle-aged and older adults in the LMD and their greater health risks when compared with their CSFII counterparts. Nutritionally inadequate diets can contribute to or exacerbate chronic and acute diseases, hasten the development of degenerative diseases associated with aging, and delay recovery from illnesses (Stallings, 2003). The LMD has a high prevalence of heart disease, hypertension, and obesity (Smith et al., 1999). There is compelling evidence that a diet rich in fruits and vegetables can lower the risk of heart disease and stroke (Hung et al., 2004; Liu et al., 2000; Joshipura et al., 1999; Appel et al., 1997). In the Harvard-based Nurses' Health Study and Health Professionals Follow-up Study, researchers found that the higher the average daily intake of fruits and vegetables, the lower the chances of developing cardiovascular disease (Hung et al., 2004).

Providing nutrition education to rural elderly persons as part of preventive measures against developing diet-related chronic degenerative health problems will help them to remain functional in their community, maintain their quality of life, and help society to minimize health care costs (Lee et al., 1998). Longitudinal studies show that health promotion activities extend the number of years of health in older people, although the relationship weakens in older age (Chernoff, 2001).

The present research has some limitations such as using a single 24-hour recall that may not reflect usual intake. In addition, the

dietary recall method has been shown to result in the underreporting of dietary intakes, especially among less educated and female respondents (Klesges et al., 1994). The ethnic constitution of the sample may limit generalization to other subpopulations outside the Southern region.

Findings from this study provide a better understanding of types of dietary changes needed to improve the eating patterns among the middle and older adults in LMD. Monitoring the total quality of diets enables food and nutrition professionals to develop and implement individual and program-level guidance to prevent the decline in functional status and independence that are often associated with aging persons (Fisher, 2007). With the projected number of rural US middle-aged and older adults, it is critical that more programs focusing on healthy eating and weight are implemented in this subpopulation. Extensive efforts toward targeting rural, low income African Americans to increase consumption of dairy products, fruits and vegetables, and lower total and saturated fat are warranted. Information obtained from this intervention will enable researchers to design interventions for at-risk groups in the middle-aged and older adult population in other rural regions.

Received: May 2007
Revised: September 2007
Accepted: September 2007

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